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Experimental Investigations of Root and Tuber Processing: Implications for Neanderthal Diet and Behavior

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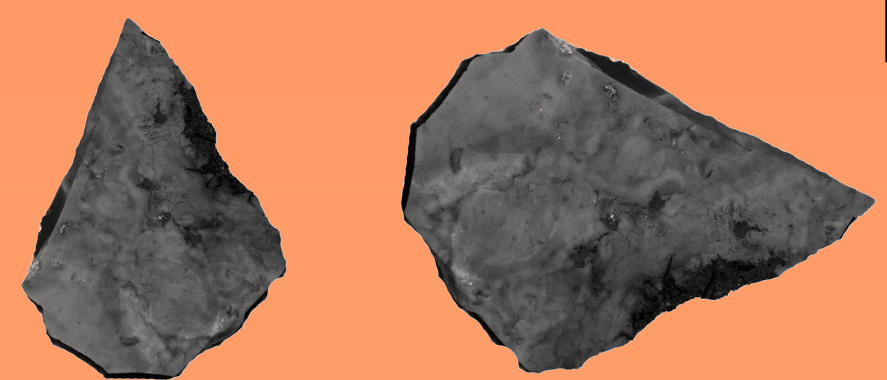
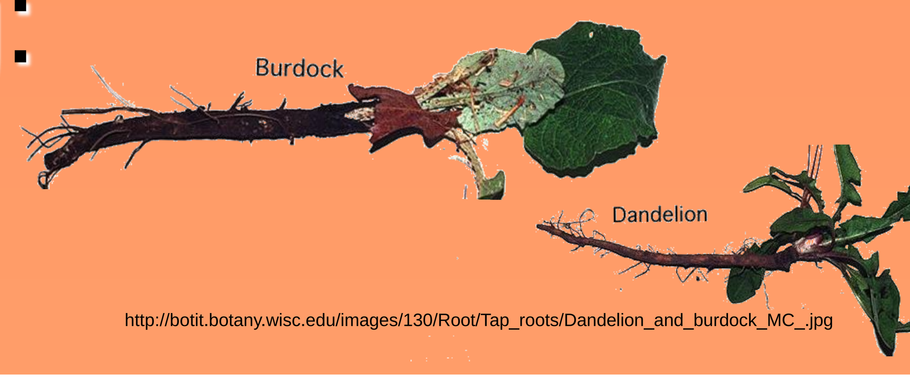


Experimental Investigations of Root and Tuber Processing: Implications for Neanderthal Diet and Behavior

Michelle Pino, Bruce Hardy, PhD.



http://botit.botany.wisc.edu/images/130/Root/Tap_roots/Dandelion_and_burdock_MC_.jpg

Abstract

Archaeologists often compare Neanderthals to high latitude foragers such as the Inuit, implying heavy reliance on animal resources for fulfillment of nutritional requirements while disregarding plant foods. Plant remains do not generally preserve at archaeological sites, but microscopic use-residues on stone tools can reveal otherwise invisible plant remains. These have been identified at Neanderthal sites, but specific identification has been difficult due to a lack of comparative material. Replica flint tools were used to process wild edible plants typical of high latitude climates. Plant remains were catalogued using reflected light microscopy (100-500x), which should allow for more specific identification of plant residues and help elucidate the role of plants in Neanderthal life.

Pokeweed

http://www.alchemy-works.com/Resources/phytolacca_eng.JPG

Burdock

http://www.probertencyclopaedia.com/j/Burdock.jpg

Jerusalem Artichoke

http://www.theworldwidegourmet.com/vegetables/root/jerusalem.jpg

Cattail

www.cleanlake.com/cattail1.jpg

Introduction

Archaeologists and anthropologists have historically assumed that Neanderthals living in high latitudes in Europe during the Middle Paleolithic (c. 120-30,000 years ago) consumed large quantities of meat and relied most heavily on animal resources for fulfillment of nutritional requirements. This is partially due to abundant faunal remains in the archaeological records in areas where Neanderthal sites have been identified.

The role that roots, tubers, and other plants with starchy underground storage organs might have played in the diet of Neanderthals is often overlooked by archaeologists, due to the lack of macroscopic floral remains in the archaeological record. Because of the apparent paucity of evidence, the importance of plant food in the daily life of Neanderthals is often disregarded.

Recent work examining stone tools has demonstrated that microscopic residues of the material being processed (ex. bone, hair, feathers, plant tissue) can survive on the tool surface and provide clues to the role of plant foods in early human diet (Hardy and Garufi 1998; Hardy *et al.* 2001; Hardy 2004). Starchy plant remains have been observed on stone tools, and it is suggested that the tools themselves provide a place for plant remains to adhere and can help protect plant cells from complete decomposition (Hasalm 2004).

Microscopic analysis of stone tools may provide evidence for use of plant foods and will ultimately lead to a greater understanding of Neanderthal diet and daily life.

Methods: Ethnobotany

To begin the project, a comprehensive review of ethnobotany literature on high latitude foraging groups, such as the Inuit of Alaska and Canada was conducted. This research allowed for the identification of edible plants available in historic and modern northern latitude regions. A minimum of 60 edible species were idenfied from the ethnobotanical literature. Seven of these have broad geographic ranges and were obtained locally from the Brown Family Envrionmental Center (BFEC) with the help of director Jason Larson. Six of the species gathered have edible roots or tubers. Figure 1 shows the plants that were gathered and processed in this experiment.

Evening Primrose

http://www.herbs2000.com/images/herbs_evening_primrose.jpg

Figure 1. Plants gathered and processed

Common name	Family	Genus	Species	Edible part	Prep 1	Prep 2
Arrowhead, Duck potato [1, 3]	Alismataceae	*Sagittaria*	*spp.*	root	boiled	
Dandelion [1, 3, 4]	Compositae	*Taraxacum*	*officinale*	leaves, roots	raw	cooked
Burdock [1, 3]	Compositae/ Asteraceae	*Arctium*	*lappa*	root, leaves	boiled (root)	raw (leaves)
Jerusalem artichoke [1,3]	Compositae/ Asteraceae	*Helianthus*	*tuberosus*	tuber	raw	
Evening primrose [1,3]	Onagraceae	*Oenothera*	*biennis*	root	scraped, boiled	
Pokeweed [1, 3]	Phytolaccaceae	*Phytolacca*	*americana*	shoots (roots = poison)	peeled	boiled
Cattail [1, 2, 3]	Typhaceae	*Typha*	*latifolia*	roots, base of stem, flower spikes	cooked (root)	raw (stem)

1. Facciola 1990; 2. Heller 1981; 3. Peterson 1977; 4. Young and Hall 1969

Methods: Experimental stone tool replication and use

Replicas of Neanderthal stone tools were produced by hard hammer percussion of flint to produce flakes. The tools produced from this technique were then used to remove the tough outer layer of the plants previously collected in an attempt to imitate the food processing patterns likely used by Neanderthals (Wrangham *et al.* 1999). Two types of use-actions were applied in this experiment: whittling and slicing (Figure 2).

For each experiment, the technique used, the plant species and part modified, and flake type were recorded. Seven controls (one from each species) were obtained, 14 tools were left on the ground surface at the BFEC plot, while 49 were buried 6-12 inches below ground surface.

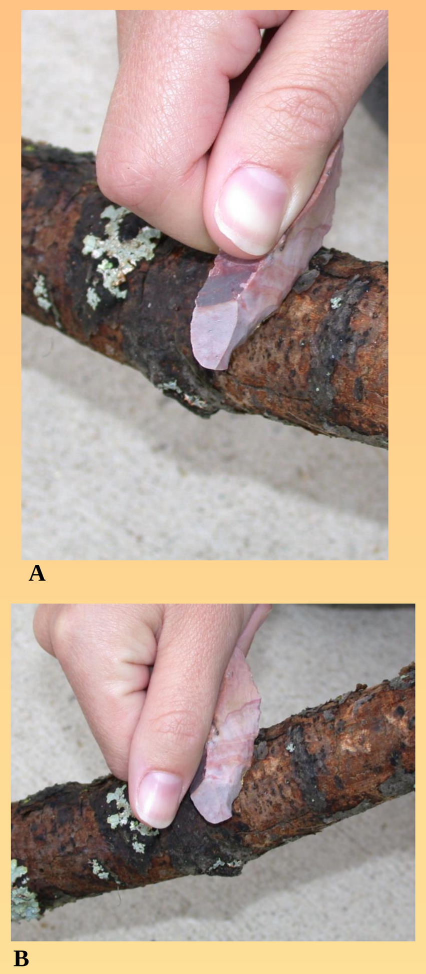


Figure 2. Use-actions.

A) Slicing: the flake edge is held perpendicularly to the material, and is slid back and forth in order to create a groove. This action slices the plant and separates parts.

B) Whittling: the flake edge is held at a 45 degree angle and is dragged in one direction either towards or away from the person yielding the tool. This action results in the peeling of the plant.

Analysis

Microscopic analysis of of control sample stone tools was conducted with an Olympus BH-2 microscope using bright field incident light at magnifications ranging from 50x to 500x. All traces of plant residue identified microscopically were photographed, hand-drawn, and catalogued. The buried tools will be excavated after several months burial and analyzed in the same manner in order to observe the effects of degradation on plant residues. This research will be conducted throughout the semester and will contribute to the author's Honors thesis.

Arrowhead

www.aquaticsystems.us/arrowhd.jpg

Dandelion

www.yourdictionary.com/images/ahd/jpg/A4dandel.jpg

Acknowledgements

I would like to thank Professor Bruce Hardy for his endless patience and guidance during the course of this project, and would like to thank him in advance for graciously continuing to work as my mentor as I continue my research throughout the year. I would also like to thank Jason Larson, Heidi May, and the rest of the Brown Family Environmental Center (BFEC) employees. Without Jason's assistance I would have been stranded in a field with a guidebook, a shovel, and no clue. The BFEC yielded valuable access to wild edible plants and also provided ample space for me to bury my stone tools. I must also thank the Kenyon Summer Science Scholars program, which funded the research and allowed me to buy groceries. Last, but certainly not least, I'd like to thank Adam Sutter for all his efforts and assistance in the manual labor of digging up plants, burying tools, and for providing much needed support.

Results

Microscopic analysis of the two control tool samples revealed preservation of plant material on unburied stone tools two months after the initial plant processing occurred. Certain features such as cell pitting and starch grains (Figures 3 and 4) can be observed, which facilitates accurate identification of plant type and species.

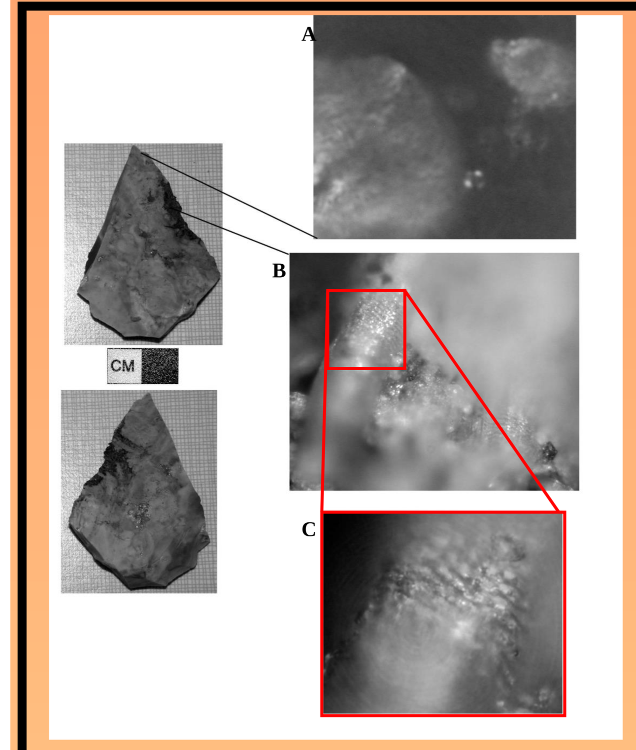


Figure 3. Microscopic remains of *Arctium lappa* on stone tool. A) starch grain and plant tissue (500x); B) cellular pitting (100x); C) inset of cellular pitting (500x)

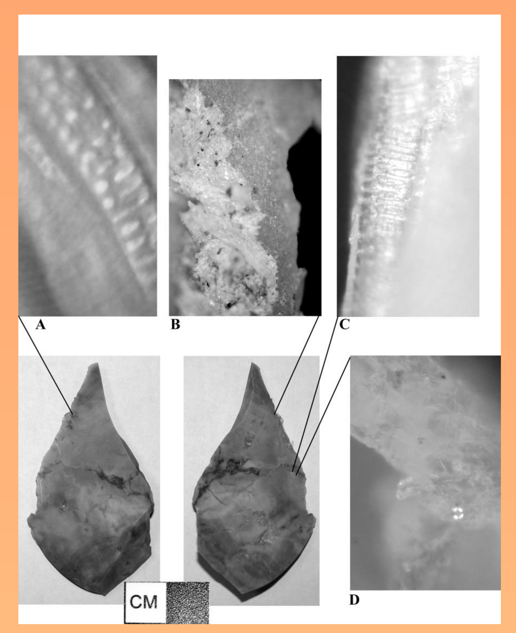


Figure 4. Microscopic remains of *Daucus carota* on stone tool; A) alternate intervessel pitting (500x). B) plant tissue on edge (100x); C) scalariform pitting (500x); D) starch grain and plant tissue (500x)

Pitting: Pits are thin portions of the cell wall that allow substances to pass through from cell to cell (Fahn 1967:36). The structure of pits can easily be seen though the microscope. Pitting can occur in different patterns within a plant tissue, and these patterns are often specific to a type of plant. Recognizing pitting patterns can help the researcher accurately identify the type of plant being examined.

Starch grains: Starch grains are solid food reserve particles that are produced by plant cells. Starch grains vary in size and shape, but are most commonly spherical or egg-shaped (Fahn 1967:15). When viewed under cross-polarized light, starch grains exhibit a black extinction cross which is diagnostic. The size and shape of the starch grain identified can lend accuracy to the identification of the plant material examined.

Discussion

The proper identification of starchy plant cells on stone tools can provide additional information about Neanderthal diet, and may indicate a larger emphasis on plant foods among Neanderthals for adequate nutritional intake than is generally accepted. The research conducted in this project will ultimately lead to a comparative guide for archaeologists studying plant remains found on ancient tool surfaces from Neanderthal sites. Future work may include nutritional analysis of the plants studied in order to show what Benefits Neanderthals may have had if these plants were indeed incorporated into their diet.

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